[0022] A still further object of the present invention is to provide a high-performance, isotropic, resin-bonded magnet substantially comprising an (Sm, La) -T-N isotropic magnet powder having an improved magnetizability compared with the conventional resin-bonded magnet, R'-T'-B isotropic magnet powder and a binder.

[0023] A still further object of the present invention is to provide a rotating machine and magnet roll both constituted by such an isotropic, resin-bonded magnet.

[0024] A still further object of the present invention is to provide a compound and the method of producing it for such an isotropic, resin-bonded magnet.

DISCLOSURE OF THE INVENTION

[0025] The isotropic, resin-bonded magnet according to an embodiment of the present invention substantially comprises R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R is at least one of rare earth elements including Y, Sm being indispensable, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, and a binder, in the form of a sheet-shaped, molded product having a thickness of 0.1-5 mm, with the maximum roughness (Rmax) defined by JIS B 0601 decreased to 15 mu m or less.

[0026] The sheet-shaped, isotropic, resin-bonded magnet of the present invention is suitable for magnet appliances having small magnetic gaps.

[0027] The isotropic, resin-bonded magnet according to another embodiment of the present invention substantially comprises (a) R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R is at least one of rare earth elements including Y, Sm being indispensable, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, (b) R'-T'-B magnet powder comprising as a main phase an R'2T'14B-type intermetallic compound, wherein R' is at least one of rare earth elements including Y, Nd being indispensable, and T' is Fe or Fe and Co, and having an average crystal grain size of 0.01-0.5 mu m, and (c) a binder bonding the above two kinds of magnet powder, is molded to a sheet-shaped, isotropic, resin-bonded magnet having a thickness of 0.1-5 mm, decreases a maximum roughness (Rmax) defined by JIS B 0601 to 15 mu m or less.

[0028] The sheet-shaped, isotropic, resin-bonded magnet of the present invention has high (BH)max and is suitable for magnet appliances having small magnetic gaps.

[0029] The isotropic, resin-bonded magnet according to a further embodiment of the present invention substantially comprises R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R is at least one of rare earth elements including Y, Sm being indispensable, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, and a binder, in the form of a ring-shaped or cylindrical, molded product with the deviation of its outer diameter from a diameter of a true circle decreased to 15 mu m or less.

[0030] In the above ring-shaped, isotropic, resin-bonded magnet, the deviation of its inner diameter from a diameter of a true circle can be decreased to 15 mu m or less.

[0031] The ring-shaped or cylindrical, isotropic, resin-bonded magnet of the present invention is suitable for magnet appliances having small magnetic gaps.

[0032] The isotropic, resin-bonded magnet according to a still further embodiment of the present invention substantially comprises (a) R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R is at least one of rare earth elements including Y, Sm being indispensable, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, (b) R'-T'-B magnet powder comprising as a main phase R'2T'14B-type intermetallic

English Translation of CN 1337049A

compound, wherein R' is at least one of rare earth elements including Y, Nd being indispensable and T' is Fe or Fe and Co, and having an average crystal grain size of 0.01-0.5 mu m, and (c) a binder bonding the above two kinds of magnet powder, in the form of a ring-shaped or cylindrical, molded product with the deviation of its outer diameter from a diameter of a true circle decreased to 15 mu m or less.

[0033] In the above ring-shaped, isotropic, resin-bonded magnet, the deviation of its inner diameter from a diameter of a true circle (roundness of inner surface) can be decreased to 15 mu m or less.

[0034] The ring-shaped or cylindrical, isotropic, resin-bonded magnet of the present invention is suitable for magnet appliances having small magnetic gaps ✓ mentioned in the Office Action

[0035] The isotropic, resin-bonded magnet according to a still further embodiment of the present invention substantially comprises R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R comprises Sm, La and inevitable rare earth elements, the content of La being 0.05-2 atomic %, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, and a binder, in the form of a sheet-shaped, molded product having a thickness of 0.1-5 mm. Here, the inevitable rare earth elements are other rare earth elements than Sm and La, such as Nd, Ce, etc., which may enter in recycling. The sheet-shaped, resin-bonded magnet is excellent in magnetizability.

[0036] The above sheet-shaped, resin-bonded magnet can be provided with a decreased surface roughness of 15 mu m or less, expressed by the maximum roughness Rmax defined by JIS B 0601, suitable for magnet appliances having small magnetic gaps.

[0037] The isotropic, resin-bonded magnet according to a still further embodiment of the present invention substantially comprises (a) R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R comprises Sm, La and inevitable rare earth elements, the content of La being 0.05-2 atomic %, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, (b) R'-T'-B magnet powder comprising as a main phase R'2T'14B-type intermetallic compound, wherein R' is at least one of rare earth elements including Y, Nd being indispensable, and T' is Fe or Fe and Co, and having an average crystal grain size of 0.01-0.5 mu m, and (c) a binder bonding the above two kinds of magnet powder.

[0038] The isotropic, resin-bonded magnet has improved magnetizability by contribution of the R-T-N magnet powder, and high (BH)max by contribution of the R'-T'-B magnet powder.

[0039] The isotropic resin-bonded magnet is useful in the form of a sheet-shaped, molded product having a thickness of 0.1-5 mm. Particularly a sheet-shaped, isotropic, resin-bonded magnet having the maximum roughness Rmax (defined by JIS B 0601) decreased to 15 mu m or less is suitable for magnet appliances having small magnetic gaps.

[0040] With the above R-T-N magnet powder comprising a hard magnetic phase having a Th2Zn17- or Th2Ni17-type crystal structure as a main phase, the main phase having an average crystal grain size of 0.01-1 mu m, the isotropic, resin-bonded magnet can be provided with improved durability (cracking resistance, etc.). With the R-T-N magnet powder compising a hard magnetic phase having a TbCu7-type crystal structure as a main phase, the main phase having an average crystal grain size of 0.002-0.5 mu m, the isotropic, resin-bonded magnet can be provided with high (BH)max.

[0041] The rotating machine constituted by using the above isotropic, resin-bonded magnet has high performance. The magnet roll constituted by the above isotropic, resin-bonded magnet can be assembled in copiers and printers providing high-accuracy pictures.

[0042] The isotropic compound according to an embodiment of the present invention comprises R-T-N magnet powder having a main component composition represented by R alpha T100-(alpha + beta + gamma + delta)M beta B gamma N delta by atomic %, wherein R substantially comprises Sm, La and inevitable rare earth elements, the content of La being 0.05-2 atomic %, T is Fe or Fe and Co, M is at least one element selected from the group consisting of Al, Ti, V, Cr, Mn, Cu, Ga, Zr, Nb, Mo, Hf, Ta, W and Zn, and 4≦ delta and alpha , beta , gamma and delta satisfy 4≦ alpha ≦15, 0≦ beta ≦10, 0≦ gamma ≦4 and 4≦ delta ≦30, respectively, and a binder. This compound provides isotropic, resin-bonded magnets with improved magnetizability.

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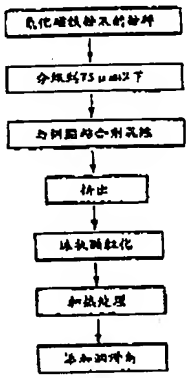
[54]发明名称 各向同性组合物及其制法，各向同性粘合磁铁、旋转机和磁辊

[57]摘要

一种各向同性粘合磁铁，实际上由具有以原子%计为 $R_\alpha T_{100-(\alpha+\beta+\gamma+\delta)} M_\beta B_\gamma N_\delta$（R 是包含 Y 在内的稀土类元素中的至少 1 种，必须含有 Sm，T 是 Fe 或 Fe 和 Co，M 是选自 Al，Ti，V，Cr，Mn，Cu，Ga，Zr，Nb，Mo，Hf，Ta，W 和 Zn 中的至少 1 种，α，β，γ 和 δ 分别满足 $4 \leq \alpha \leq 15$，$0 \leq \beta \leq 10$，$0 \leq \gamma \leq 4$，和 $4 \leq \delta \leq 30$），表示的主成分组成的 R－T－N 系磁铁粉末和粘合剂形成的，加工成厚度 0.1～5mm 的片状，根据 JIS B0601 的规定最大粗糙度 R_{max} 降低到 15μm 以下。



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β，γ和δ分别满足4≤α≤15，0≤β≤10，0≤γ≤4，和4≤δ≤30)所表示主成分组成的R-T-N系磁铁粉末，(b)是以R'$_2$T'$_{14}$B型金属间化合物(R'是包含Y在内的稀土类元素中的至少1种，必须含有Nd，T'是Fe或Fe和Co)为主相的平均结晶粒径为0.01～0.5μm的R'-T'-B系磁铁粉末；(c)是将上述2种磁铁粉末进行粘合的粘合剂。

上述环状各向同性粘合磁铁的内径真圆的直径偏差(内周面的真圆度)降低到15μm以下。

本发明的环状或圆柱状各向同性粘合磁铁适宜用于磁间隙小的磁铁用制品。

根据本发明又一方案的各向同性粘合磁铁，其特征是，实际上由具有以原子%为$R_\alpha T_{100-(\alpha+\beta+\gamma+\delta)}M_\beta B_\gamma N_\delta$(R是由Sm, La及不可避免的稀土类元素构成，La的含量为0.05-2原子%，T是Fe或Fe和Co、M是选自Al、Ti、V、Cr、Mn、Cu、Ga、Zr、Nb、Mo、Hf、Ta、W及Zn中的至少1种，α，β，γ和δ分别满足4≤α≤15，0≤β≤10，0≤γ≤4，和4≤δ≤30)所表示的主成分组成的R-T-N系磁铁粉末和粘合剂构成的，形成厚度0.1-5mm的片状。这里所说的不可避免的稀土类元素是除Sm, La以外的稀土类元素，是由于再循环而混入的Nd，Ce等。这种片状粘合磁铁是富有磁化性的磁铁。

上述片状粘合磁铁的表面粗糙度，按照JIS B 0601所规定的最大粗糙度R_{max}，降低到15μm以下，所以适宜用于磁间隙小的磁铁应用制品。

根据本发明再一方案的各向同性粘合磁铁，其特征是，实际上由以下(a)、(b)和(c)所构成。其中(a)是具有以原子%为$R_\alpha T_{100-(\alpha+\beta+\gamma+\delta)}M_\beta B_\gamma N_\delta$(R是由Sm, La和不可避免的稀土类元素形成，La的含量为0.05-2原子%，T是Fe或Fe和Co、M是选自Al、Ti、V、Cr、Mn、Cu、Ga、Zr、Nb、Mo、Hf、Ta、W和Zn中的至少1种，α，β，γ和δ分别满足4≤α≤15，0≤β≤10，0≤γ≤4，和4≤δ≤30)所表示的主成分组成的R-T-N系磁铁粉末，(b)是以R'$_2$T'$_{14}$B型金属间化合物(R'是包含Y在内的稀土类元素中的至少1种，必须含有Nd，T'是Fe或Fe和Co)为主相的平均结晶粒径为0.01-0.5μm的R'-T'-B系磁铁粉末，(c)是将上述2种磁铁粉末进行粘合的粘合剂。

这种各向同性粘合磁铁，有助于提高R-T-N系磁铁粉末的磁化性，有助于提高R'-T'-B系磁铁粉末的$(BH)_{max}$。

形成厚度为0.01～5mm片状的各向同性粘合磁铁是有用的。特别是，按